10.—Vertebrate Remains from the Nullarbor Caves, Western Australia

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Six caves, Cocklebiddy Cave, Murraelellevan Cave, Madura Cave, Webb's Cave, Snake Pit and Abrakurrie Cave, located along the southern edge of the Nullarbor Plain, have yielded the remains of Pleistocene and Recent vertebrates. The Recent material extends the known range of one species, *Pseudomys (Thetomys) occidentalis*, 600 miles eastward. Remains of *Potorous* from Webb's Cave are intermediate morphologically between *Potorous platyops* from Western Australia and *Potorous morgani* from Kangaroo Island, South Australia. Webb's Cave also contains remains of *Sarcophilus harrisi* in association with recently introduced species. In the lower, red soil unit of Madura Cave a P_3 of *Sthenurus* and a wombat tooth similar in size to *Phascolomys parvus* have been found. The presence of *Sthenurus* in Pleistocene deposits in this area suggests a more humid climate at that time.

Introduction

Numerous caves have been known in the Cretaceous and Tertiary limestones along the southern edge of the Nullarbor Plain since Tate reported them in 1879. The isolated and desolate nature of this region, however, has delayed the study of the caves and their deposits.

The present study was undertaken to locate caves which contain fossiliferous deposits which could be used to reconstruct the faunal and climatic history of the area.

The caves considered here extend from the vicinity of Cocklebiddy Tank, 140 miles east of Balladonia, to the South Australian boundary (Fig. 1). Additional caves are known from the Nullarbor Plain in South Australia but have not been investigated by the author.

This report is based on a three-week reconnaissance trip along the Eyre Highway during August, 1955.

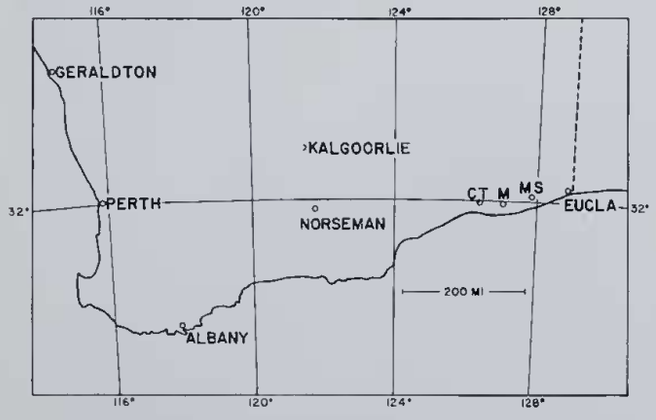

Fig. 1.—Map of southern Western Australia. CT Cocklebiddy Tank, M Madura, MS Mundrabilla Station.

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Vertebrate remains were found in six caves. A Recent age for most of the deposits is indicated by the remains of the house mouse, *Mus musculus*, and the European rabbit, *Oryctolagus cuniculus*. Other deposits are older and one goes back as far as the Pleistocene although no precise dates are available at the present time. Brief descriptions of the caves and faunal lists are presented here in the belief that the information will be useful to studies of the recent fauna, and to call attention to the possibility of studying the faunal history of this region.

The author (Lundelius 1957) has previously reported range extensions of a number of species of mammals based on remains from Recent deposits of these caves. These species are listed here along with two species, *Pseudomys (Gyomys) occidentalis* and *Lasiorhinus latifrons* which were identified after publication of the 1957 paper.

The faunal lists contain only the mammals. The identification of the avian and reptilian material proved impossible because of lack of adequate comparative material.

Cocklebiddy Cave

Cocklebiddy Cave is a large cave located about five miles north of the Eyre Highway, 135 miles east of Balladonia. The only deposits in the cave are composed of large boulders of limestone derived from the roof collapse which formed the opening. Bones are sparsely distributed on the surfaces of the boulders. The material consists of well-preserved bones of small reptiles, birds and mammals (Table I). The material was probably brought into the cave by owls. The mammals have been previously known from the Nullarbor Plains area.

Murraelellevan Cave

Murraelellevan Cave is located four and one half miles west of Cocklebiddy Tank. The opening has been formed by roof collapse. A vertical walled pit with a sloping floor of rock debris leads to a large underground chamber on the east side. The remains of animals were collected from a limited area under the overhanging roof, most of which represent material frem the regurgitated pellets of owls. Many of the pellets were not completely broken down and still retained some of their original form. A few kangaroo bones were also found.

All but one of the species found in this cave have been recorded previously from this area. The exception is *Pseudomys (Gyomys) occidentalis* Tate which is rare in the deposit. It has been known previously from the southwestern part of Western Australia (Tate 1951).

TABLE I

Faunal List from Cocklebiddy, Murraelellevan, Webb's, and Snake Pit Caves

	Cocklebiddy Cave	Murraellevan Cave	Webb's Cave and Snake Pit Cave
Order Marsupialia			
Family Dasyuridae			
Dasyurus geoffroyi (Gould)	..	+	+
Dasycercus cristicauda Krefft	+	+	+
Phascogale calura Gould	.	+	+
Sminthopsis crassicaudata (Gould)	+	+	..
Antechinomys sp.	+	+	+
Sarcophilus harrisi (Boitard)	...	....	+
Family Peramelidae			
Macrotis lagotis (Reid)	+	+	+
Perameles bougainvillei Quoy and Gaimard	-	+	-
Family Phalangeridae			
Trichosurus vulpecula Kerr	.	+	-
Cercartetus concinnus	.	+	
Pseudocheirus occidentalis (Thomas)		..	+
Family Macropodidae			
Bettongia lesueuri (Quoy and Gaimard)		-	+
Bettongia penicillata Gray		...	+
Lagorchestes hirsutus Gould		+	
Macropus sp.		+	+
Potorous platyops (Gould)		...	+
Caloprymnus campestris (Gould)		...	+
Order Rodentia			
Family Muridae			
Leporillus conditor (Sturt)	+	+	
Leporillus apicalus (Gould)		+	+
Notomys mitchelli (Ogilby)	+	+	+
Pseudomys rawlinnae Troughton	+		+
Pseudomys (*Gyomys*) *occidentalis* Tate		+	...
Leggadina hermannsburgensis (Waite)		+	+
Mus musculus Linnaeus		+	
Order Chiroptera			
Nyctophilus geoffroyi Leach		+	
Order Lagomorpha			
Oryctolagus cuniculus (Linnaeus)		+	

Its presence in these surface deposits indicates that it is a part of the Recent fauna of the Nullarbor Plain and extends its range 600 miles eastward. The Nullarbor specimens show some minor differences from those from farther west. These differences will be reported in detail in a later study.

Madura Cave

Madura Cave is located six miles south of Madura on the road from Madura to the coast. It is a small cave whose entrance has been formed by collapse of the roof. Two passages lead from the collapsed area, one to the south-west for approximately one hundred feet where it ends, the other extends north-west for approximately 275 feet where it divides into two passages which extend on for an additional 200 feet before becoming too small to enter. Frost (1958) has published a sketch map of the cave.

The NW-SE passage is partly filled with sediment from which the bones were collected. Some of the fill is now being removed by channelling.

Two test trenches were dug. Trench 1 was sunk near the opening. It was excavated to a total depth of 3 feet without reaching the bed rock floor of the cave. The upper 2½ feet of fill consists of fine, light brown silt with abundant bones in the top six inches. The lower six inches consists of red earth with limestone fragments up to eight inches in diameter. The bone in this lower layer is scarce and badly broken.

Trench 2 was sunk at the point at which the cave divides into two passages. The upper layer of brown silt is absent. The fill at this point consists of one foot of red soil with rocks up to six inches in diameter underlain by 14 inches of alternating, crossbedded layers of white sand and dark silt which rests on the limestone floor of the cave. The bone in both layers is badly broken.

With the exception of the wombat, all the species obtained from the upper brown silt in Trench 1 have been known previously from the area. *Lasiorhinus latifrons* occurs today in the Nullarbor Plain of South Australia almost to the boundary of Western Australia. Its presence in Madura Cave is approximately 110 miles west of its present known occurrence, but within the range accorded it in old reports of an anecdotal kind (Jenkins 1962).

The exact age of the brown unit is not known. The fact that the present drainage in the cave is entrenched in the fill indicates that erosion is the dominant process in the cave today. Thus the deposition of the brown unit and the bones predates the present entrenching but not necessarily by a very long time.

The material from the lower red soil unit is too sparse to give any real idea of the fauna at the time of its deposition. As in the upper unit the only species which is not known from the area at present is the wombat. This species is represented by one tooth which is inadequate for an accurate specific identification. The size of the tooth is within the range of *Phascolomys parvus*, a Pleistocene species, but it could equally well represent a juvenile individual of *L. latifrons*.

TABLE II

Faunal List from Madura Cave

	Trench 1		Trench 2
	Top 1 foot	2½ feet below surface	2½ feet below surface
Order Marsupialia			
Family Dasyuridae			
Sminthopsis crassicaudata (Gould)	+	-	
Antechinomys sp.	+		
Dasycercus cristicauda Krefft		+	+
Phascogale calura Gould	+		
Family Peramelidae			
Macrotis lagotis (Reid)	+		
Perameles bougainvillei Quoy and Gaimard	+		-
Family Macropodidae			
Macropus sp.			-
Sthenurus sp.			-
Bettongia lesueuri (Quoy and Gaimard)			
Lagorchestes hirsutus Gould	+		-
Family Phascolomyidae	+		
Order Rodentia			
Family Muridae			
Notomys mitchelli (Ogilby)		+	+
Leporillus conditor (Sturt)	+	+	+
Leporillus apicalis (Gould)	+	+	+
Leggadina hermannsburgensis (Waite)	+		+
Pseudomys rawlinnae Troughton	+		+

The material from the red soil zone of Trench 2 contains remains of Recent species, with the addition of a lower third premolar of the extinct *Sthenurus* (Fig. 2). *Sthenurus* has been recorded in Western Australia from Mammoth Cave (*S. occidentalis*—Glauert 1910) and from Balladonia (*S. atlas**—Glauert 1912).

The new material cannot be assigned to either of these species. The presence of *Sthenurus* probably indicates a late Pleistocene or early Recent age for this unit. Gill (1955) reports the most recent C^{14} date for *Sthenurus* in eastern Australia as 13,000 years and Tedford (1955) assigns a late Pleistocene or early Recent date on *Sthenurus* from Lake Menindee in New South Wales.†

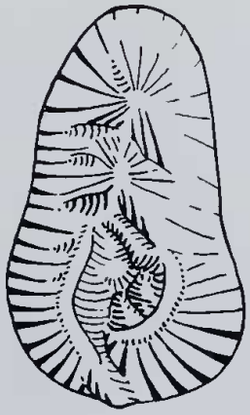

Fig. 2.—P_3 of *Sthenurus* sp. from Madura Cave. (CNHM PM4356). (X3.)

Macropus is represented by a portion of a right mandible with M_4 intact. The mandible and the proportions of the M_4 closely resemble those of *M. rufus* but are slightly larger than any the writer has seen. The difference is not great and probably does not justify separating it from *M. rufus*.

Webb's Cave and Snake Pit Cave

Webb's Cave and Snake Pit Cave are located just north of the Hampton Scarp at Mundrabilla Station homestead. Both caves are small and are located within a mile of one another. The floors of both caves are formed of large blocks of limestone which have fallen from the roof. Most of the bones occur in a very thin layer of silt and dust (rarely exceeding one foot) on the surface of the larger blocks. Remains of *Mus musculus* and rabbits, both European imports, indicate that the deposit is of very recent age.

The bones in Snake Pit Cave appear to be derived from animals which fell in and died. The opening is a sinkhole which would be a natural trap for animals.

The bones in Webb's Cave appear to have been brought in by owls and predators. The small animals are represented by unbroken

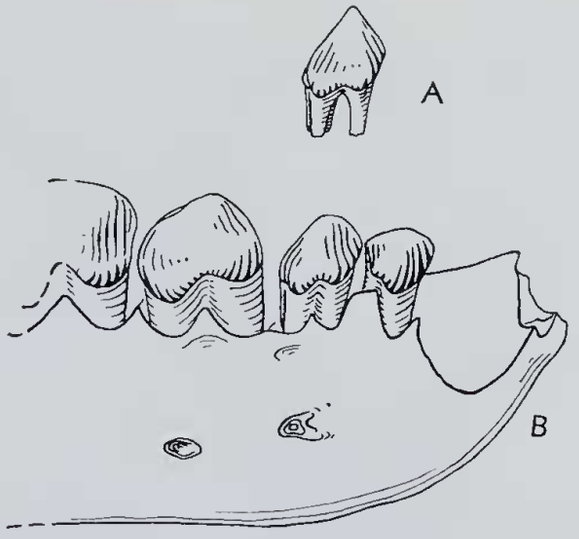

Fig. 3.—Labial view of (A) right P_2 of *Sarcophilus harrisi* (CNHM PM4354) from Webb's Cave, (B) mandible (CNHM PM4353) from Wedge's Cave, Western Australia. (X2.5 approximately.)

mandibles, limb bones, and skulls. The bones of larger species are usually badly broken, probably by predators.

All of the species except *Sarcophilus harrisi*, which is indicated by one lower premolar (Figs. 3 and 4), have been reported previously from the Nullarbor Plains. The specimen is almost identical with a lower premolar of a specimen from Wedge's Cave at Mimegara, Western Australia. In addition, the broken condition of most of the larger bones indicates the presence

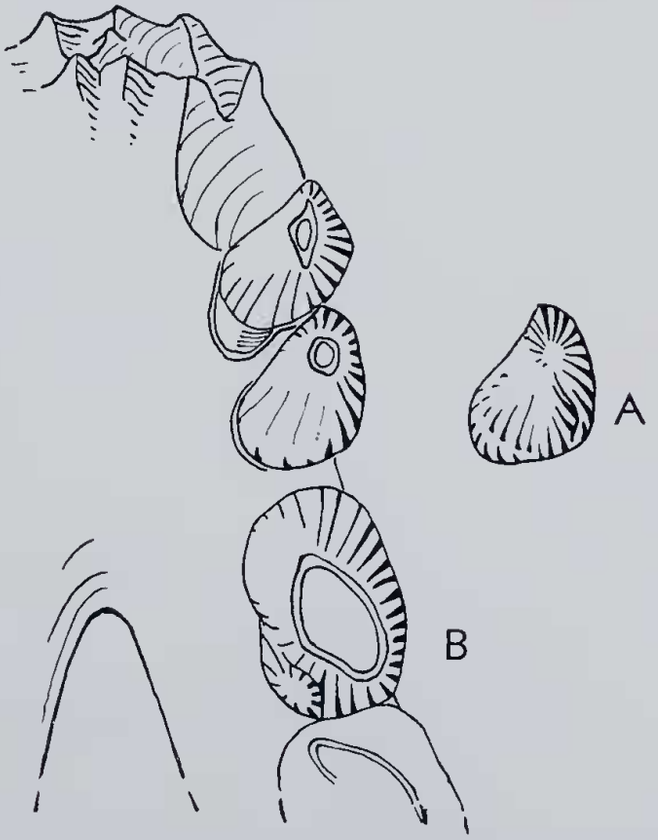

Fig. 4.—Occlusal view of (A) right P_2 of *Sarcophilus harrisi* from Webb's Cave, (B) mandible from Wedge's Cave, Western Australia. (X3 approximately).

* The paper by Marcus (1962), in which doubt is cast on the identification of Balladonia material as *Sthenurus atlas*, was received too late for consideration.

† It appears now that the latter dates are in error (Tedford, pers. comm.); efforts are being made to obtain an accurate date.

of a relatively large carnivore. This association of broken bones and the remains of *Sarcophilus* has been reported by the author (Lundelius 1960) in two other Western Australian caves. The presence of *Sarcophilus* in very recent deposits is extremely interesting but not wholly unexpected in the light of reports of its occurrence in Australia (Jones 1923) and a record of it in Victoria dated at 500 years (Gill 1955). This indicates a very recent disappearance of this animal from the Australian mainland.

Another very interesting occurrence in Webb's Cave is *Potorous platyops*. The material consists of one immature skull with the right and left deciduous P^2 and the left deciduous P^3. The right side of the palate is completely preserved and shows an unerupted M^4.

Although the comparison of immature and mature individuals is often hazardous this occurrence is of sufficient importance to warrant the comparison of this specimen with *P. platyops* and *P. morgani*. The comparisons are based on description and figures in Finlayson (1938) and some fragmentary material from cave deposits along the west coast of Australia.

The Nullarbor specimen agrees with *P. platyops* and differs from *P. morgani* in having a definite restriction of the interorbital area. *P. morgani* has a parallel sided interorbital area. On the other hand it differs from *P. platyops* in having the posterior part of the nasals less expanded.

The deciduous P^2-^{3} present in the Nullarbor specimen have not been described in either *P. platyops* or *P. morgani* so no comparisons can be made of the dentitions. The deciduous P^2 is a simple blade composed of two cusps of which the anterior is the larger. The two cusps are connected by a thin ridge which bears two very shallow grooves on its inner and outer surfaces. The anterior cusp bears a tiny tubercle on its anterior edge. The inner basal surface is strongly convex.

The deciduous P^3 is subquadrangular in outline with the greatest length along the outside edge. The two outer cusps are of the same size and stand higher than the two inner cusps. They are connected by a low ridge. The antero-external cusp has an anterior blade like extension which is responsible for the long outer edge. The two lingual cusps are equal in size. The two anterior and posterior cusps are connected by low ridges. A posterior cingular ridge is present.

The only molar present is the right M^4 which is unerupted. The alveoli of the other molars indicate that their relative sizes are $M^2 < M^1 < M^3 < M^4$.

This occurrence of *P. platyops* in the Nullarbor area is geographically intermediate between the type locality of *P. platyops* in Western Australia and that of *P. morgani* on Kangaroo Island, and might be expected to shed some light on the relationship between *P. platyops* and *P. morgani*. As noted above, the Nullarbor specimen is morphologically intermediate but the nature of the material prevents a comprehensive comparison.

In any consideration of the relationship of the two species it should be kept in mind that Kangaroo Island is very close to the mainland and the maximum depth of water between them is 120 feet (British Admiralty Chart; Australia,

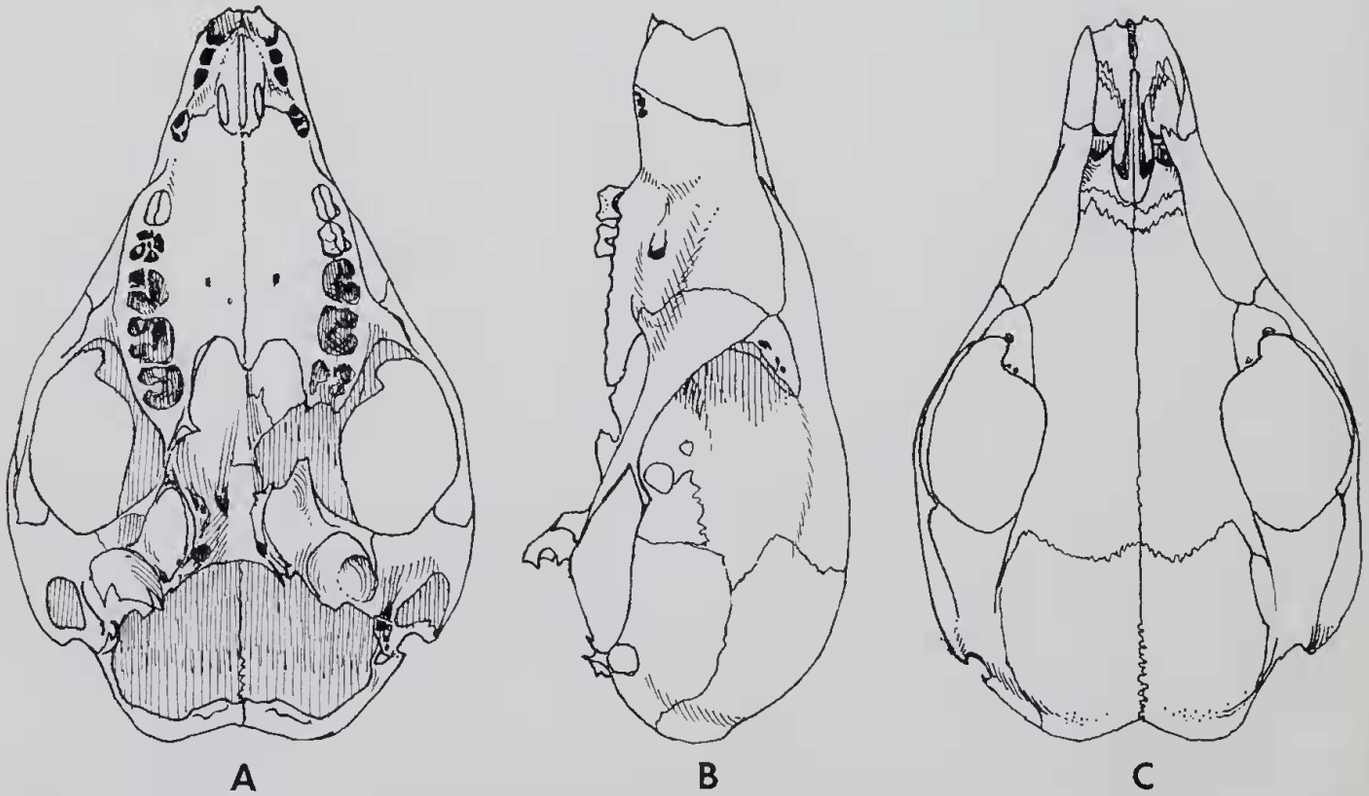

Fig. 5.—Ventral view (A), lateral view (B), and dorsal view (C) of *Potorous platyops* (CNHM PM4355) from Webb's Cave. (X1.5 approximately.)

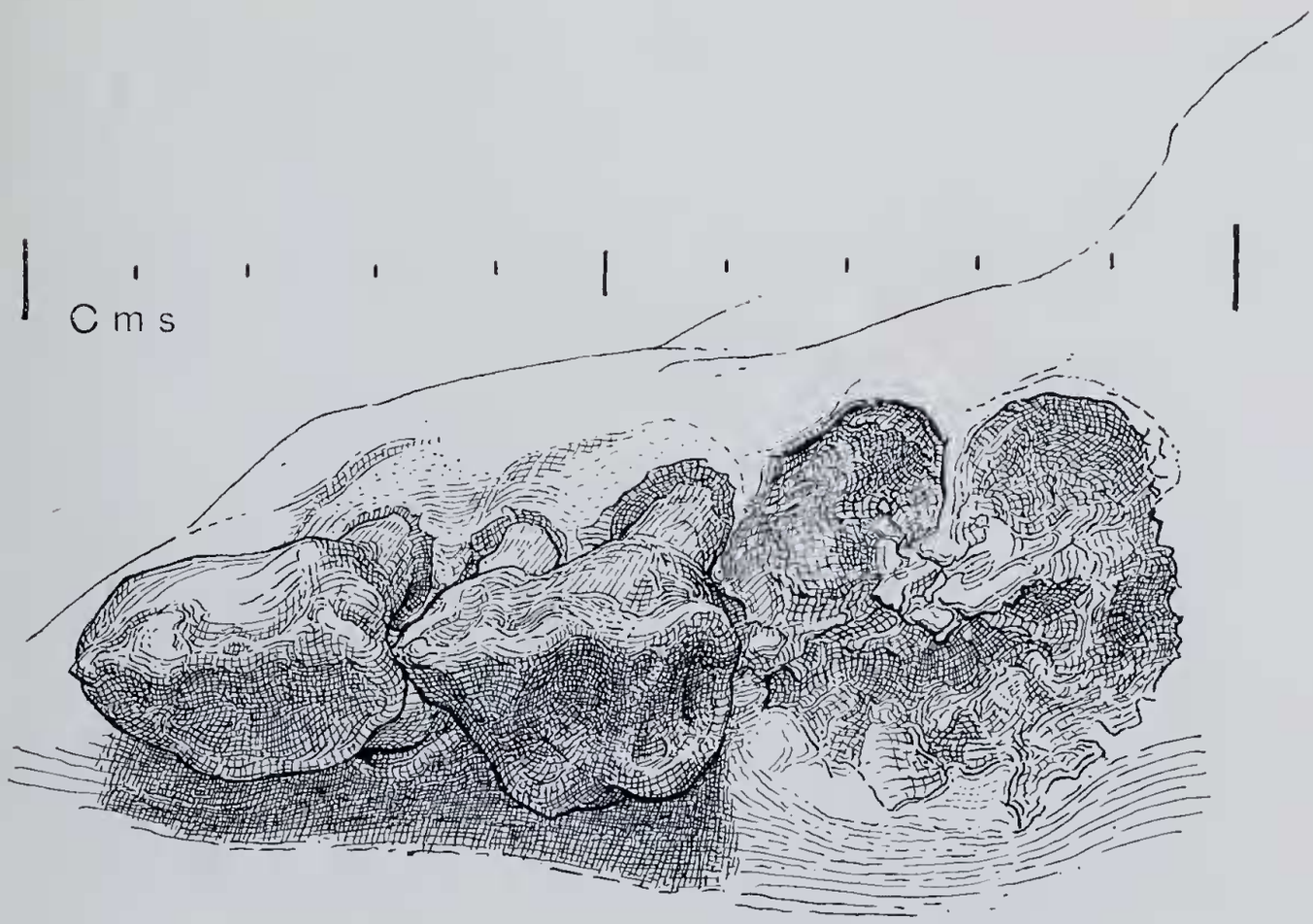

Fig. 6.—Occlusal view of P^{2-3} of *Potorous platyops* (CNHM PM4355).

Southern Portion). This indicates that its separation from the mainland is probably a result of the post glacial sea level rise (Godwin *et al.* 1958). Thus it is quite possible that the two species of *Potorous* under discussion actually represent different populations of the same species which was widespread along the south coast of Australia. More complete material from the Nullarbor Plain is needed to settle this question.

Abrakurrie Cave

Abrakurrie Cave is located 25 miles north of Eucla. It is a large cave with a high arched roof. The entrance was formed by roof collapse. The fill consists of red silt with some limestone gravel near the entrance. The profile of the walls and roof of the cave suggest that the fill may be quite deep. Test trenches were dug to a depth of 2½ feet without encountering the bed rock floor of the cave. Almost all the vertebrate remains were collected from the upper one foot of fill near the entrance. Table III shows the distribution of the species by levels in the cave. All of these have been reported previously from this area.

Six of the seven caves investigated by the author contained the remains of vertebrates. This indicates that there is a good chance of obtaining cave deposits which will yield a faunal sequence. From this can be inferred the climatic history.

TABLE III

Faunal List from Abrakurrie Cave

	Surface	2 feet below surface
Order Marsupialia		
Family Dasyuridae		
Dasyurus geoffroyi (Gould)	+	. .
Dasycercus cristicauda Krefft	+	+
Antechinomys sp.	+	+
Sminthopsis crassicaudata (Gould)	+	. . .
Family Peramelidae		
Macrotis lagotis (Reid)	+	. . .
Perameles bougainvillei Quoy and Gaimard	+	. . .
Family Macropodidae		
Bettongia lesueuri (Quoy and Gaimard)	+	. . .
Bettongia penicillata Gray	+	. . .
Macropus sp.	. . . .	+
Order Rodentia		
Family Muridae		
Notomys mitchelli (Ogilby)	+	+
Pseudomys rowlinnae Troughton	+	. .
Leggadina hermannsburgensis (Waite)	+	. . .
Leporillus conditor (Sturt)	+	. . .
Leporillus apicalis (Gould)	+	. . .

A knowledge of the faunal and climatic history of the Nullarbor Plain would be very useful in checking ideas concerning the speciation patterns in some Western Australian animals. Main, Lee and Littlejohn (1958) and Serventy (1951) have explained the existence of several closely related species of frogs and birds in Western Australia as the result of successive faunal movements from eastern Australia to

Western Australia during humid periods of the Pleistocene. Intervening arid periods are postulated as periods of isolation of the eastern and western faunas. The humid periods are believed to be correlated with the glacial stages of the Pleistocene, the arid periods with the interglacial stages. The southern part of the Nullarbor Plain is the most likely route of these faunal movements.

The only data concerning the faunal history of the Nullarbor Plain come from a fossil fauna reported by Glauert (1912) from a swamp deposit at Balladonia. This fauna is of Pleistocene age and indicates a more moist climate than the present. Unfortunately only the remains of the larger animals were recovered. Cave deposits usually contain abundant remains of small animals which allow a more precise interpretation of the climate. It should also be possible to recover material for C^{14} dates which will be useful in checking the correlation of the humid periods with glacial stages.

The most promising of the caves described here is Madura Cave, as the presence of *Sthenurus* in the lower unit indicates a Pleistocene age. Very little of the fill was removed by the author thus leaving a large quantity for future excavation. Future investigations should bring to light additional caves with fossiliferous deposits.

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